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Human Hand Recognition System based on the Moving Object Detection, Color of the Skin and Face Recognition System

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ABSTRACT: In this paper we are going to study and analyse the detection of human hand present in a real time video. There are many algorithms which will discuss about the detection of hand based on the concept of the moving object and by using only the color of the object. Each of these concepts has their own disadvantages. In order to overcome the disadvantages we are going to a new method of identifying the hand in the videos by using the combination of the motion detection and color of the skin. So this method of identifying the hand will not detect the object as hand if it is an object having motion with or without skin color and also it is an object with motion having skin kind of color. So this method helps in detecting the object in any video which is having both motion and skin color as parameters will be identified as hand. This method is easy to understand, implement and fast when compared to other methods of hand recognition algorithms.

Keywords: skin color detection, moving object detection, computer vision.

I INTRODUCTION

The topic we are discussing now is a part of computer vision [4]. Computer vision is a branch of the computer science where we are involved in making the machines to work like human beings. That means in the machines we are going to embed the algorithms which will help in making the machines to work accordingly [9]. The algorithm may be face detection, image enhancement, segmentation, motion detection, object detection, human being detection and recognition and also it may be hand detection in a video. The hand detection may be considered as identifying the object in a video. There are many methods of object detection such as background registration and background subtraction [6]. In the background registration case video is taken in which the starting twenty frames are taken. The mean of these twenty frames is taken resulting in a single frame. This single frame is saved as background. This is said to be background registration.

Another method of the object detection is by using the concept of the template matching. In the template matching case, a template of the object is taken that is made to scan throughout the frame of the video and if the template and frame contents are matched highly that means the correlation values between the template and image contents are peak when compared to other areas of the frame, the areas in which correlation values are of peak value. Those areas are considered as the objects of interest.



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The paper is going to be classified as follows. Here section II discusses about the old methods of hand detection in an image/video. Section III discusses about the proposed method of the hand detection. Section IV discusses about the results of the hand detection for different scenarios/cases. Section V discusses about the conclusion and future studies.

II RELATED WORKS

The traditional methods of the hand detection are of two types. They are

- 1) Hand detection by using the moving object detection algorithm [6].
- 2) Hand detection by using the skin color [9].

Method 1: In the method of detection of the hand by using the moving object concept, we are considering the video having the hands. Moving detection algorithm helps in exactly identifying the hands objects using a fixed (x, y) coordinate position of a pixel. In the meanwhile if any other moving object comes in front of the camera, in that scenario, the moving object other than the hand will also be identified as hand. The following figure shows the results of the moving object detection using the moving object detection algorithm.

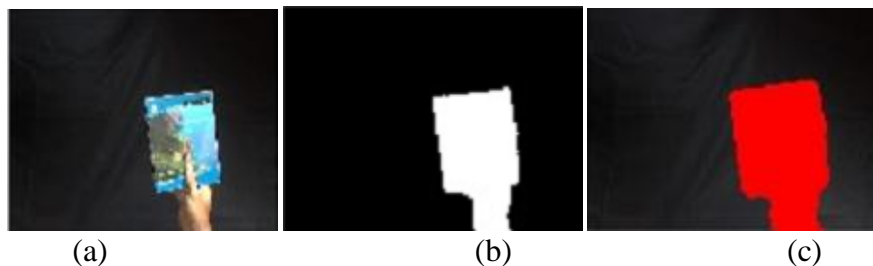


Figure 1

In figure (1), (a) Input image (b) Detected Object Mask (c) Detected Object, here the red colored area is part of the moving object identified as hand. Here some part of the detected object is wrongly detected as hand.

Here in the figure (1), image (a) is one frame of the video having both the hand and non-hand object. Here our intension is to identify only the hand. But the moving object detection algorithm will identify both objects as hand. So this is drawback of this algorithm.

Method 2: In the method of identifying the hand in a video uses the skin color of the object. So we are here going to identify the skin color of the object. The skin color of the object is identified by using the following formula. The employs converting the RGB frame of the video into HSV format and YCbCr format. There is Matlab function for converting the RGB image into the HSV (Hue – Saturation - Value). But for converting the RGB image into the YCbCr(Y is the luma-intensity component and CB is blue-difference and CR is red-difference chroma components.) image, we are employing the following conversion. The

$$Y = 0.2990*R+0.5870*G+0.1140*B$$

$$Cb = -0.1687*R-0.3313*G+0.5000*B+128$$



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$$Cr = 0.5000*R+0.4187*G-0.0813*B+128$$

For determining the skin color of an object the H, Cb and Cr components are considered for an RGB pixel value. And check whether the Cr value is in the range of 140 to 165 and Cb is in the range of 140 to 195 and Hue color is in the range of 0.01 to 0.1.

If the conditions stated above are satisfied, then that segment of the image is considered as skin color. The following figure shows the results of the object detection using the using the skin color parameter.

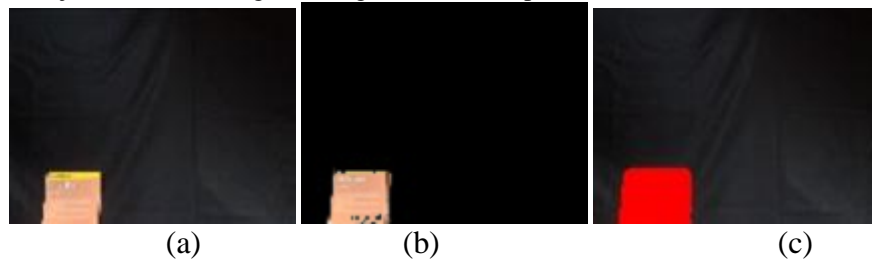


Figure (2)

In figure (2), (a) represents the input image with object having the skin color.(b)objects identified with the skin colors (c) represents the results with red colored mask on the object detected wrongly as hand.

III PROPOSED METHOD

To overcome the drawbacks that are discussed in the above two methods, we are making use of the combination of said methods to propose a new method that will provide the output for the correct detection of the hand objects in the given video. That means object must be moving and also the moving object must be having the skin color to detect the object as hand only. Here even if any moving object having the skin color comes, area of the skin part of the image is considered to decide whether the object is hand or not. So that this proposed method will exactly identifies the image having hand object as hand only. This proposed algorithm is as shown in the following figure (3).



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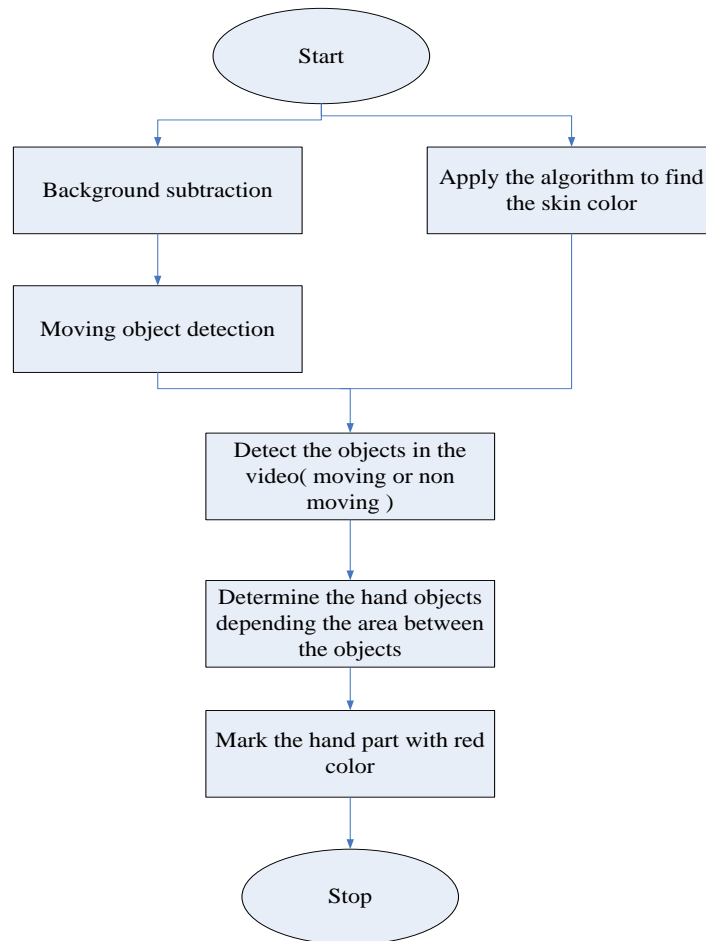


Fig (3)

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IV RESULTS

The following figure shows the results of the proposed method.

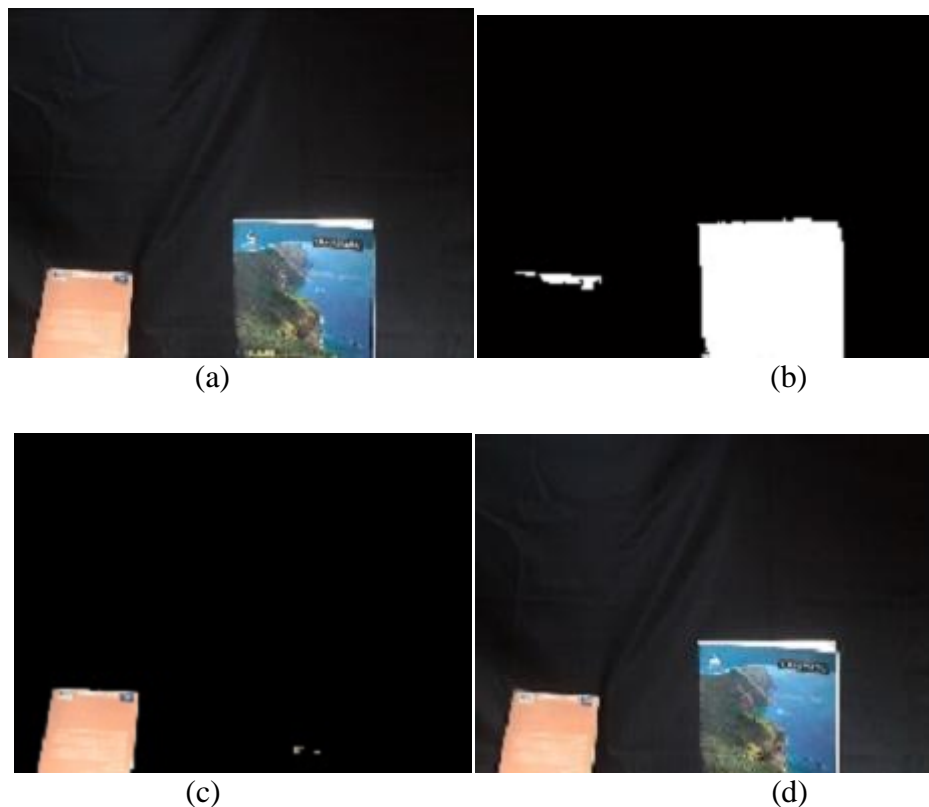


Figure (4)

In the figure (4), (a) is the input image having the skin colored constant object. (b) Motion detected objects. (c) Showing the objects having the skin color. (d) No objects are identified.

From the figure 4 it is observed that though there is a skin colour constant object(book) and a motion detected object(movement of the book), the end result shows no object detection that is hand is not detected.

The figure (5) shows the results for the case where hand and skin colored non hand object being together. In this case we have the image of hand and also a book of skin colour. By using the proposed algorithm only the hand is detected and not the book.



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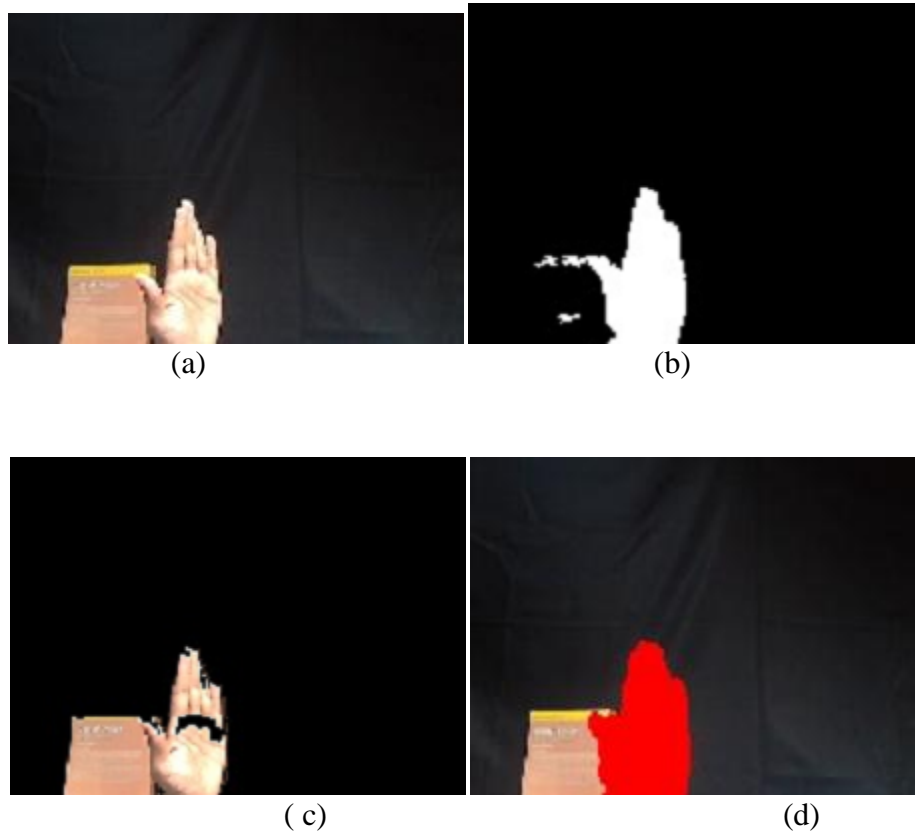


Figure (5)

(a) Represents the input image having hand and also non-hand with skin color. (b) Represents the objects with motion (c) Segments of the objects having the skin color. (d) Represents correct hand object with hand object being marked by the red mask.

Figure(6) shows another case study results. In this case the closed part of the hand is not detected. Only the exposed part of the hand is detected and is shown in red colour.

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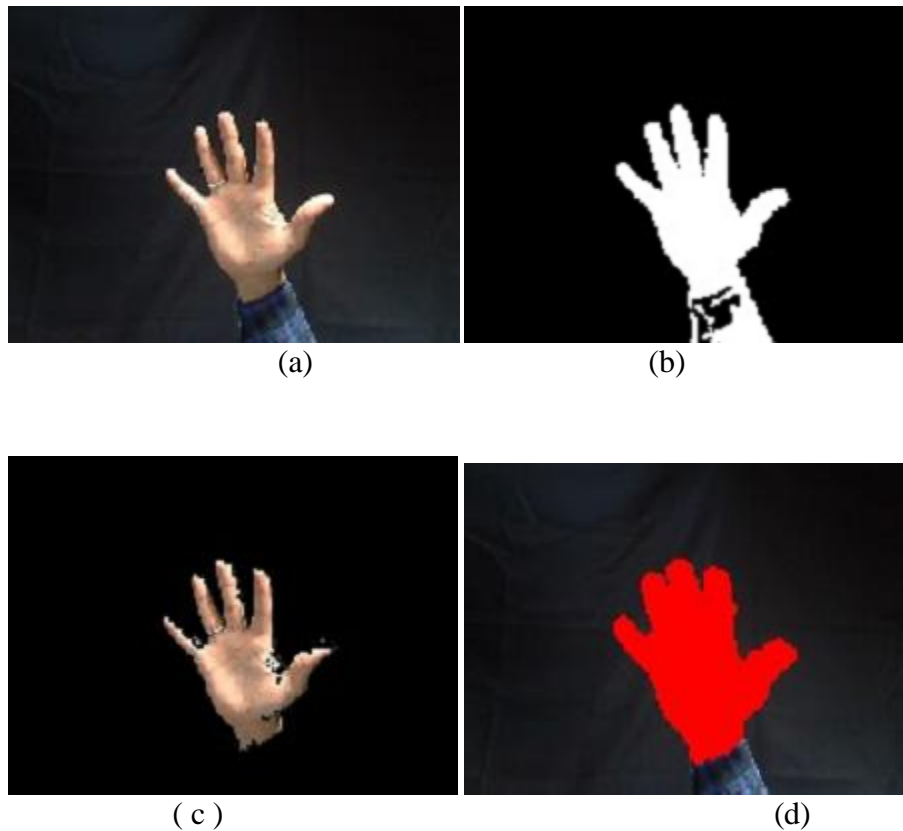


Figure (6)

(a) is input image having hand object with some part being covered. (b) Represents the motion object. (c) Represents skin segmentation part that is the part having the skin color on the object. (d) Red colored mask on the detected hand portion of the hand.

Figure (7) shows one more case study results. In this case we consider a real time image which has both non-moving hand and a moving object with skin color. By applying our algorithm only the hand is detected and not the moving object with the same skin colour.

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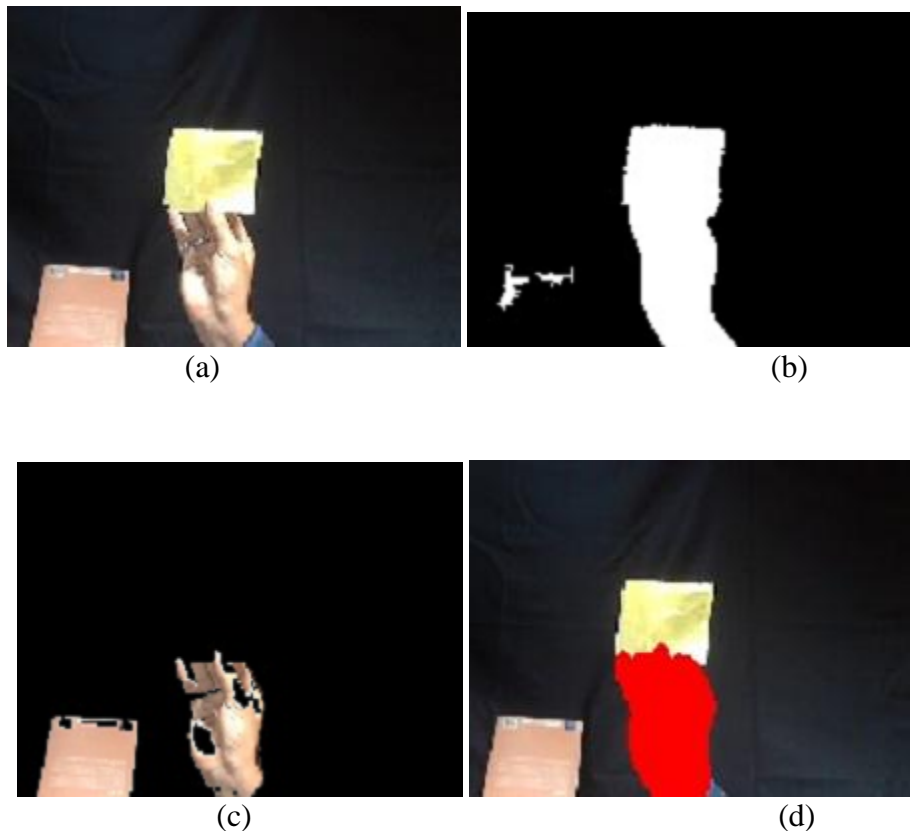


Figure (7)

(a) represents the input image with hand, non-moving and moving skin colored objects. (b) Detected moving objects. (c) Detected objects with the skin color. (d) Red colored marked portion represents the hand object present in the image.

V COMPARATIVE STUDY

Here the comparative study is about the methods of hand recognition system. The methods of recognition described above are

- 1) Finding the hand depending on the skin color.
- 2) Finding the hand depending on the movements of hand object.
- 3) Finding the hand using the combination of the above (1) and(2) methods

In the third method we are facing a drawback that if any other moving object having the skin color other than the hand such as face comes in front of the camera, then that object will also be identified as hand. To overcome this drawback we are employing the face recognition system to identify the face in the video/image. The face part if comes while recognizing the hand, that part is filtered out to retain only hand. This is the new proposed system. So the proposed new method is giving good results compared to the other methods.

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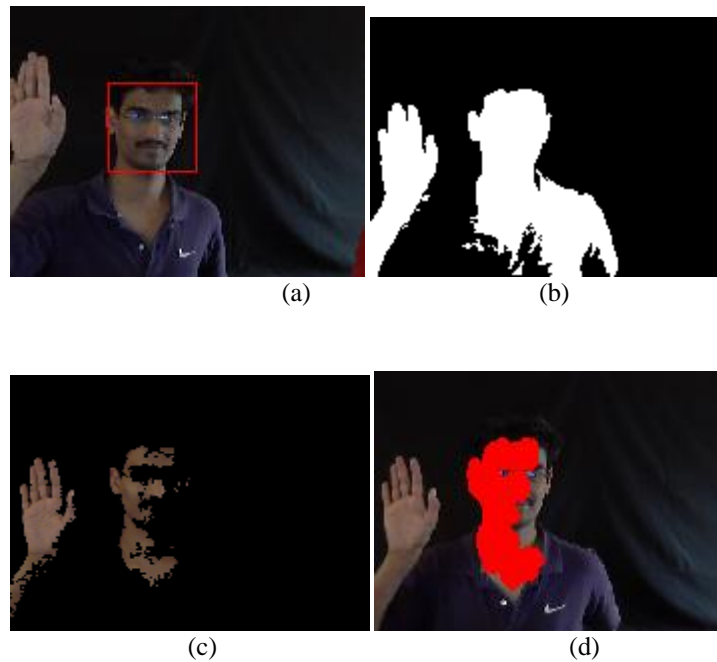
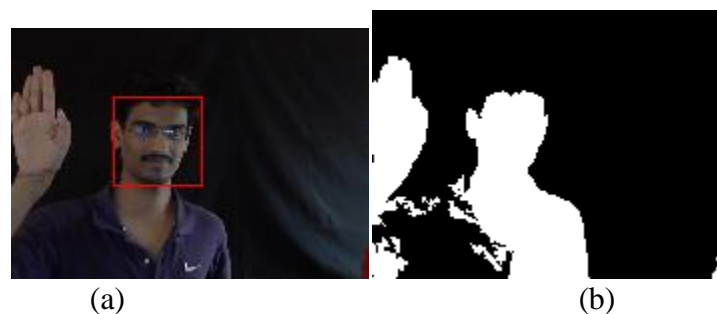


Fig (8)

(a) is input image, (b) is Motion detected image, (c) Skin segmented image and (d) is Detected hand image where the face part is identified as hand by the red high light.

Figure (8) shows the output for the drawback where face of the person is identified instead of identifying his hand. The above drawback is identified by filtering the face part in the input image. The results are shown below fig 9.





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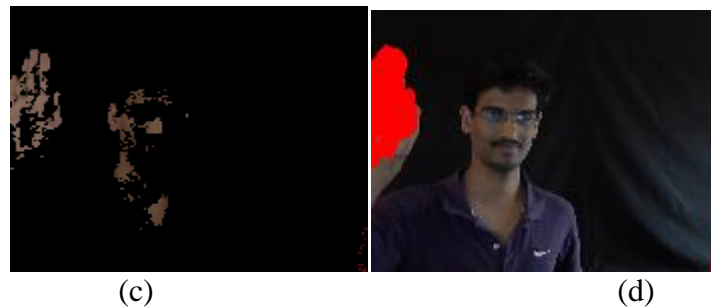


Fig (9)

(a) is input image , (b) is motion detected image (c) is Skin segmented image and (d) is hand detected image.

Thus in fig 9 only the hand is detected.

V. CONCLUSION

The proposed method of the hand detection which uses the face recognition system to filter out the objects related to face is giving the better results when compared to the previous methods of hand detection such as hand detection based on the moving object detection and hand detection based on the skin color of the hand. The algorithm is subjected to a variety of scenarios. In all the cases, the proposed algorithm is giving the correct results of hand detection.

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